Corn Yield Response to Applications of Fungicide and Nitrogen Application Method and Timing

Purpose:

With the advent of more readily accessible high clearance application equipment, there has been considerable discussion in regards to the use of high clearance application equipment to deliver crop inputs to corn at times which have previously not been as feasible (ie. taller corn), particularly with the aims of pushing yields through promoting greater kernel set. Intensive, unconventional management practices such as these are often promoted by corn-yield contest growers for breaking through 'yield barriers'. This project has been developed to investigate the influence of application timing of foliar fungicides, foliar nitrogen fertilizer, and soil surface applied fertilizers on kernel set and yield in grain corn.

Methods:

Two separate trials were conducted in 2014. A "nitrogen and fungicide application method" trial was conducted at Elora and Bornholm. Corn was planted at 32,000 seeds per acre with a 15-15-15 starter fertilizer blend delivered in a 2"x2" band at 100 lbs/ac. Four main application treatments were evaluated at each trial, and consisted of a 50 lb-N/ac soil applied UAN treatment (via coulter injector at side-dress (V6) timing, or Y-Drop applicator at VT timing), a foliar Alpine Slow Release Nitrogen (SRN) treatment, a Priaxor fungicide application, and the above 50 lb-N/ac Y-Drop treatment combined with a Priaxor fungicide application (Table 2). To investigate the influence of application timing on yield, the four application treatments were applied at both a sidedress (V6 for nitrogen, V10 for SRN/Priaxor) and topdress (VT) timing. Total nitrogen rates were kept relatively low (70 lb-N/ac preplant + 15 lb-N/ac planter) to ensure nitrogen related treatments would be in a nitrogen responsive range. To account for potential nitrogen rate by application treatment interactions, the application treatments were also conducted under a more conventional 135 lb-N/ac (120 lb-N/ac preplant + 15 lb-N/ac planter). A series of 4 N-rates (0, 70, 120 and 170 lb-N/ac) were also applied at preplant timing to serve as control plots and to calculate the maximum economic rate of nitrogen (MERN) at each trial.

A "high yield" trial was also conducted at Elora in 2014. Seven main treatments were applied, and included a control (no application), and applications of either Alpine SRN or Priaxor made at the V10 stage, tasseling stage, or both (Table 3). The same treatments were conducted across two seeding rates of 36,000 seeds per acre (36K) and 44,000 seeds per acre (44K). Prior to planting, the trial received 105-35-35 (N-P_2O_5-K_2O) via a spring strip tillage application. A 6-28-28 starter fertilizer blend was applied at a rate of 150 lbsN/ac, while 120 lbsN/ac was applied as a sidedress application of UAN.

Figure 1. Tow-behind sprayer modified for high clearance applications to small-plot corn trials

Plots for both trials were 4 rows wide and 50’ in length and were randomized and replicated 4 times at each location. At the nitrogen and fungicide trial, all nitrogen applications were made as UAN. Preplant applications of nitrogen were made by a calibrated hand boom, while V10 applications were made using a 3-point hitch mounted coulter injector, while VT applications were made using Y-Drop applicators mounted on a modified Hardi tow-behind sprayer with alleys and buffer rows for driving through the trial (see Figure 1). Both SRN and Priaxor were applied by the modified sprayer with flat-fan nozzles delivering product rates of 2 gal/ac and 120 mL/ac respectively through a 20 gal/ac spray solution. To avoid nitrogen contamination between plots at the nitrogen and fungicide trial, only the middle two rows of each plot were harvested. Kernel count assessments were made at the high yield trial where 10 ears were randomly picked, dried, shelled and counted to estimate the final number of kernels per ear. Plots were harvested using a modified John Deere 6600 combine with a custom batch-weigh hopper and on-board moisture meter to calculate final plot yields. Characteristics of all three trials are presented in Table 1.

Table 1. Trial characteristics and management dates.

Trial	Planting Date	Application Date		Soil Test (ppm)	
		V10	Tassel	P	K
Elora - N and Fung. App.	May 10	June 26	July 24	9	72
Bornholm - N and Fung. App.	May 28	July 4	July 30	13	125
Elora - High Yield	May 12	June 26	July 24	9	90

Results:

Nitrogen yield response data demonstrated that maximum economic rates of nitrogen at Elora and Bornholm was 135 and 150 lbsN/ac, suggesting that yields should be responsive to nitrogen treatments under the 70 lbsN/ac preplant rate. Yield responses to applications in the nitrogen and fungicide application method trials were variable across locations (Table 2). For the SRN foliar nitrogen treatment, significant yield responses were observed for the late application timing at Bornholm under both the 70 and 120 lbsN/ac preplant treatments, while no yield response was observed for the early timing. For the Priaxor fungicide treatment, no significant yield benefits were observed for the 70 lbsN/ac preplant rates, but a significant benefit was observed at Bornholm for the 120 lbsN/ac preplant rate. When looking at fungicide by nitrogen interactions, there did not appear to be any enhanced yield benefit to fungicide applications where additional nitrogen was provided (ie. 50 lbsN/ac + Priaxor) relative to where Priaxor alone had been applied. Similarly, under the 70 lbsN/ac preplant rate where yield response to nitrogen would be expected at both locations, there was no enhanced yield response to nitrogen applied late at tasseling (50 lbsN/ac at VT) versus at sidedress (50 lbsN/ac at V6) or preplant (120 lbsN/ac preplant), though at Bornholm both the V10 and VT applications were significantly higher yielding than the preplant rate.

Table 2. Yield results at the fungicide and nitrogen application method trials at Elora and Bornholm, 2014.

Trt. No.	Preplant N (lb-N/ac)	Application Treatment	App. Timing	Elora		Bornholm	
				Yield bu/ac	LSD (5%) *	Yield bu/ac	LSD (5%) *
1	70	control (no application)		141	DE	128	FG
2	70	50 lb-N/ac	V10	156	ABCD	152	AB
3	70	SRN	V10	137	E	126	FG
4	70	Priaxor	V10	132	E	129	EFG
5	70	50 lb-N/ac + Priaxor	V10	168	A	143	BCDEF
6	70	50 lb-N/ac	VT	147	CDE	160	AB
7	70	SRN	VT	132	E	146	ABCDE
8	70	Priaxor	VT	134	E	130	DEFG
9	70	50 lb-N/ac + Priaxor	VT	156	ABCD	151	ABC
10	120	control (no application)		140	DE	132	CDEFG
11	120	50 lb-N/ac	VT	161	ABC	158	AB
12	120	SRN	VT	155	ABCD	151	AB
13	120	Priaxor	VT	149	BCDE	156	AB
14	120	50 lb-N/ac + Priaxor	VT	166	AB	162	A

** yields followed by the same letter are not significantly different at the 5% level, comparisons valid within locations only*

Yield responses were also variable at the Elora high yield trial (Table 3). Under the 36K planting, a significant yield response was observed for SRN at the V10 application, while a significant yield response was observed for Priaxor applications at the V10 and tassel applications, but not the combined V10 + tassel application. Yields appeared lower, in general, under the 44K planting. No significantly positive yield responses were observed for any applications, and in a few cases significantly lower yield responses were observed. No significant differences in the average number of kernels per plant was observed under the 36K planting (Table 4), and while significant differences were observed in the 44K planting, variation did not appear to be well correlated to yields.

Table 3. Yield results of the Elora high yield trial treatments across two seeding rates - 2014.

Treatment	36,000 seed/ac planting		44,000 seed/ac planting	
	Yield (bu/ac)	LSD (5%) *	Yield (bu/ac)	LSD (5%) *
control (no application)	219	B	223	A
Alpine SRN V10	231	A	221	AB
Alpine SRN V10 + tassel	226	AB	207	C
Alpine SRN tassel	227	AB	214	ABC
Priaxor V10	231	A	221	AB
Priaxor V10 + tassel	229	AB	213	ABC
Priaxor tassel	232	A	212	BC

** yields followed by the same letter are not significantly different at the 5% level, comparisons valid within populations only*

Table 4. Average kernel counts of the Elora high yield trial treatments across two planting rates, 2014.

Treatment	36,000 seed/ac planting		44,000 seed/ac planting	
	Kernels / Plant	LSD (5%) *	Kernels / Plant	LSD (5%) *
control (no application)	609	A	573	A
Alpine SRN V10	620	A	507	B
Alpine SRN V10 + tassel	607	A	546	AB
Alpine SRN tassel	598	A	581	A
Priaxor V10	631	A	549	AB
Priaxor V10 + tassel	622	A	560	A
Priaxor tassel	614	A	555	AB

** yields followed by the same letter are not significantly different at the 5% level, comparisons valid within populations only*

Summary:

In general, yield responses appeared variable across both trials. Calculating the maximum economic rates of nitrogen demonstrated that both locations should be responsive to nitrogen applications under the 70 lbsN/ac preplant rate. At the nitrogen and fungicide trial, the SRN foliar fertilizer significantly increased yields at the VT stage

at Bornholm, but not at Elora. Fungicide applications provided no significant yield response under low preplant N treatments, but did at the high preplant N rate at Bornholm. No enhanced yield response to fungicide was observed when applied to plots that also received additional nitrogen. Late nitrogen applications (VT) did not appear to provide any enhanced yield benefit relative to side-dress applications. At the Elora high yield trial, SRN provided a significant yield response at the V10 application, while Priaxor provided a significant yield response at both applications under the 36K planting, while no yield responses were observed under the 44K planting. Significant differences in the number of kernels per plant were only observed for the 44K planting, for which numbers did not appear to correlate well with yields.

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Project Contacts:

Greg Stewart, OMAFRA greg.stewart1@ontario.ca
Ben Rosser, University of Guelph, brosser@uoguelph.ca